

The University of Chicago

**PRESENT STATUS AND FUTURE
POSSIBILITIES OF AGRICULTURAL
LAND UTILIZATION IN PATAGONIA**

A PART OF THE DISSERTATION SUBMITTED
TO THE GRADUATE FACULTY IN CANDIDACY
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOGRAPHY

By
WELLINGTON D. JONES

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PRESENT STATUS AND FUTURE POSSIBILITIES OF AGRICULTURAL LAND UTILIZATION IN PATAGONIA¹

WELLINGTON D. JONES

AN observer traversing the length and breadth of Patagonia would see a landscape displaying few conspicuous traces of human occupation. The face of nature, in its larger lineaments and in detail, is today essentially as it was before this frontier land began to be settled some fifty years ago. Present settlement is sparse, and the earlier nomadic hunting Indian population, which lived largely on guanacos and wild ostriches, was even more thinly scattered.

TABLE I—AREA AND POPULATION OF THE SOUTHERN TERRITORIES OF ARGENTINA AND CHILE, 1920*

TERRITORY	AREA IN SQUARE MILES	POPULATION	AVERAGE POPULATION DENSITY PER SQUARE MILE
Neuquén	40,500	30,677	0.76
Río Negro	79,800	42,652	0.53
Chubut	93,500	31,021	0.33
Santa Cruz	109,100	18,462	0.17
Tierra del Fuego . .	8,300	2,608	0.31
Magallanes (Chile) .	64,800	28,960	0.45
Total	396,000	154,380	0.39

*The figures in the tables are either taken directly from the official statistical publications listed in the Bibliography under "República Argentina" and "República de Chile" or are calculations based on figures from these sources.

The government censuses taken in 1920 showed a total population of 154,380 in the 396,000 square miles of the southern territories of Argentina and Chile that approximately comprise Patagonia (Fig. 1 and Table I). Although not dense anywhere, this population

¹ This study is based primarily on field investigations made in 1911 and 1912 by the Comisión de Estudios Hidrológicos of the Bureau of Railways of the Ministry of Public Works of the Argentine Government. Professor Bailey Willis was chief of the commission, and the author of this paper was a member. Surveys of various sorts, including an appraisal of land utilization possibilities, were made in a zone along the railroad then under construction west from San Antonio to Lake Nahuel Huapi and in a zone in and just east of the Andes north from Lake Nahuel Huapi to latitude 39° 40' S. and south to latitude 43° 40' S. The available literature on the parts of Patagonia not covered by these surveys has been consulted in the preparation of this paper, at the end of which the more valuable of these sources are listed.

is rather unevenly distributed (Fig. 5), and the evidences of human occupation and use of the land vary correspondingly in intensity.

THE AGRICULTURAL REGIONS OF PATAGONIA

On the basis of differences in agricultural utilization, which differences are based fundamentally on differences in natural conditions, four major divisions of the area embraced in the six political territories listed in Table I can be distinguished (Fig. 1):

1. The sheep ranching region of the dry plains and low plateaus.
2. The oases of irrigation cropping, along the rivers of the northern half of the dry region.
3. The cattle ranching zone of the East Andean border.
4. The non-agricultural zone of the rainy, forested Andes.

Patagonia is defined in the present paper as including the southern parts of Argentina and Chile, extending from the Atlantic to the Pacific and from the southern extremity of the continent to the northern boundaries of the divisions listed above.

THE SHEEP-RANCHING REGION

The eastern two-thirds of that portion of South America that extends from somewhat north of the Río Colorado all the way south to Tierra del Fuego is very sparsely settled, semi-arid to arid plains and low plateau country that is devoted to sheep ranching (Figs. 1-3) except in the restricted areas described below. The rainfall is too low (less than 400 millimeters) for growing crops without irrigation, and, except in the valleys of a few major streams traversing the area, the possibilities of irrigation are slight. Large tracts of land in this dry plains and low plateau region are owned by companies that have fenced their properties and carry on sheep rearing by much the same methods as those practiced in the western United States and Australia. Land not in possession of the large ranching companies, however, still constitutes the bulk of the area of the region. Much of this land is unused and government-owned; some is owned and used by small landowners with relatively small flocks of sheep, and some is occupied temporarily by squatters. Both the quality of the scattered bush and bunch-grass vegetation and the possibilities for watering livestock, as well as the strong and persistent west winds, are much less favorable for cattle than for sheep, and consequently the latter everywhere predominate (Figs. 4 and 7).

TABLE II—ELEMENTS OF THE LIVESTOCK ASSOCIATIONS IN TYPE AREAS OF THE AGRICULTURAL REGIONS OF PATAGONIA AND ITS BORDERLANDS, 1920

TYPE AREA	PER CENT OF TOTAL LIVESTOCK UNITS*				
	Sheep	Cattle	Goats	Hogs	Horses and Mules†
Sheep Ranching Region of the Dry Plains and Plateaus					
Northern part (Department of 25 de Mayo, Río Negro Territory)	65	8	5	0	22
Central part (Department of Deseado, Santa Cruz Territory)	77	13	0	0	10
Southern part (Department of San Sebastian, Tierra del Fuego Territory)	93	2	0	0	5
Cattle Ranching Region of the East Andean Border (Department of Los Lagos, Neuquén Territory)	7	52	16	0	25
Cattle Ranching Region of the Monte (Department of Añelo, Neuquén Territory)	4	43	15	0	38
Grain Farming Region of the Outer Pampas (Department of Bahía Blanca, Buenos Aires Province)	31	40	0	2	27
Livestock and Grain Farming Region of South Chile (Department of Osorno, Llanquihue Province)	7	79	3	3	8

*1 livestock unit = 1 horse = 1 head of cattle = 7 sheep = 7 goats = 5 hogs. These conversion figures are based on feed requirements.

†In all cases mules are much less numerous than horses.

Ranching has altered only in slight degree the natural conditions as they were when the first settlers came into the region. Widely separated ranch houses, with their associated corrals, dipping vats, sheds, windmills, and irrigated garden patches, long stretches of wire fence far apart, an occasional gaucho on horseback, scattered flocks of grazing sheep, and the isolated huts of the poor squatters do not bulk large in a monotonously uniform landscape of plains, mesas, and canyons, with dull gray-green or gray-buff semi-desert vegetation hundreds of miles in extent.

Livestock density per square mile in this extensive region inevitably is low (Fig. 6), since the stock is grazed on the sparse natural vegetation and in most cases is given little or no supple-

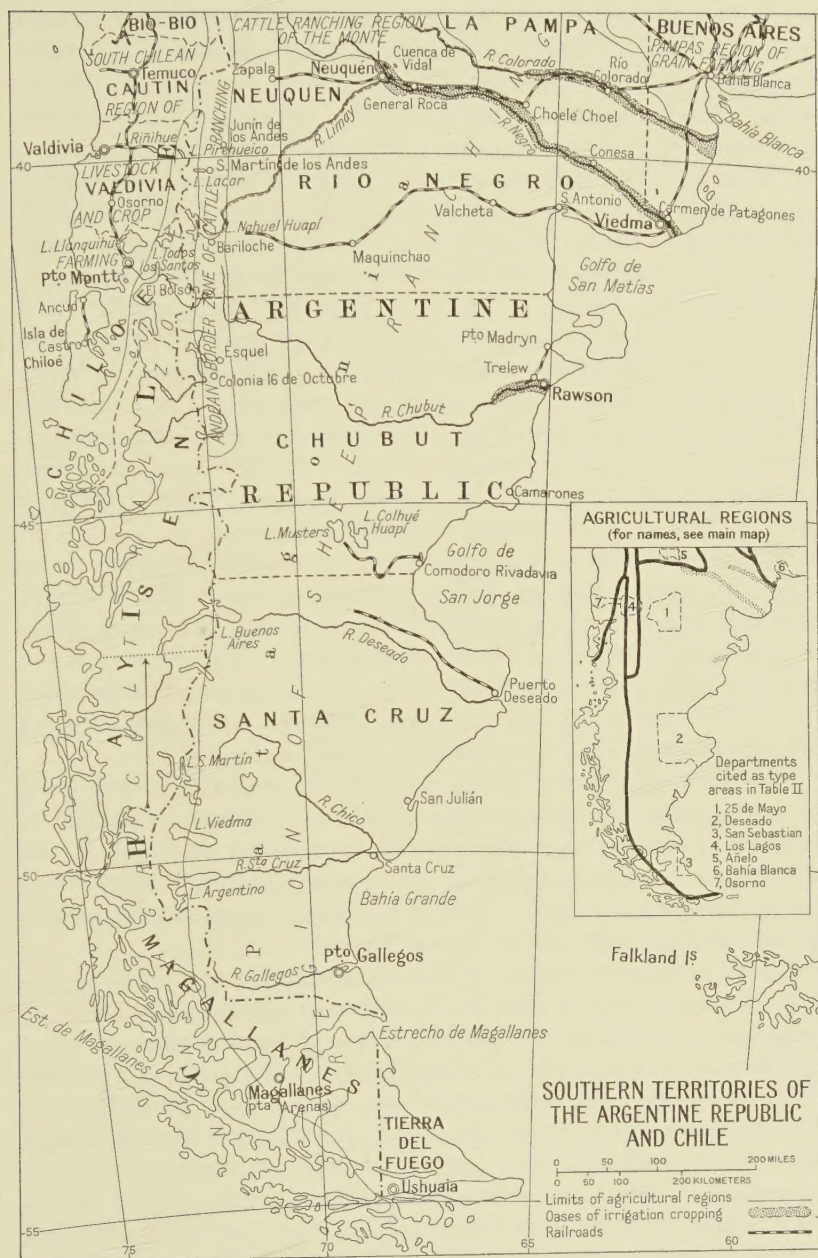


FIG. 1.—Geographical features of Patagonia referred to in the text. Scale, 1 : 12,000,000. Boundaries of territorial subdivisions of Chile are shown as defined by the decree of Dec. 30, 1927 (*Geogr. Rev.*, Vol. 19, 1929, pp. 61-77). In addition, the boundary between the Province of Llanquihue and the Territory of Magallanes, for which 1920 statistics have been employed both in text and maps, is shown at latitude 47° S.

mentary feed from crops (Fig. 8). The average livestock density per square mile, however, varies greatly from one part of the region to another, as the map shows. In part this variation in density reflects differences in carrying capacity of the ranges, due primarily to differences in vegetation that grow out of differences in climate. In part, however, this variation in livestock density probably is due to the fact that in places the available grazing land is not fully utilized. The better ranges in southern Patagonia carry as many as 200 sheep to the square mile, but throughout much of the ranching region the density is less than one third this figure. As a consequence, even the smaller ranches, with 8000 to 10,000 head of sheep, occupy several square miles, and the leasings or holdings of the companies with large herds are immense. The *Compañía Explotadora de Tierra del Fuego* with 3,600,000 acres and 1,125,000 sheep, the *Sociedad Industrial y Ganadera de Magallanes* with 1,240,000 acres, and the *Argentine Southern Land Company* with 730,000 acres are among the larger companies.

The canyons that in many places are cut into the plateau surfaces play a significant rôle in sheep ranching, especially in the winter and particularly in the southern latitudes, in that they offer places of shelter for the flocks from the cold winds. Furthermore, on the floors of these canyons greater soil moisture than on the plateaus results in better winter pasture, and, although permanent streams are rare, springs are not uncommon in the canyons.

The ranch centers are for the most part located at springs issuing from the base of mesas or canyon walls, at which sites water is available for watering stock and for ranch-house uses and in not a few cases is employed to irrigate a small garden and a few acres of supplementary forage. Such sites also give protection against the blustering winds that so frequently blow.

Towns within the region of sheep ranching are restricted to the Atlantic coast (Figs. 1 and 5), at places so located as to serve as exporters of wool and, in recent years, of some frozen mutton. Eleven such ports, most of which have a population of between 1000 and 3000, take care of the bulk of the trade of Patagonia. At all of these ports, except Magallanes and Puerto Madryn, ships must anchor offshore and load from and to lighters. Goods unloaded at these ports are not subject to the import duties (Magallanes recently was taken off the free list by Chile) imposed at ports serving the more highly developed parts of Argentina and Chile.

TABLE III—CHIEF PATAGONIAN EXPORTS TO FOREIGN COUNTRIES BY PORTS

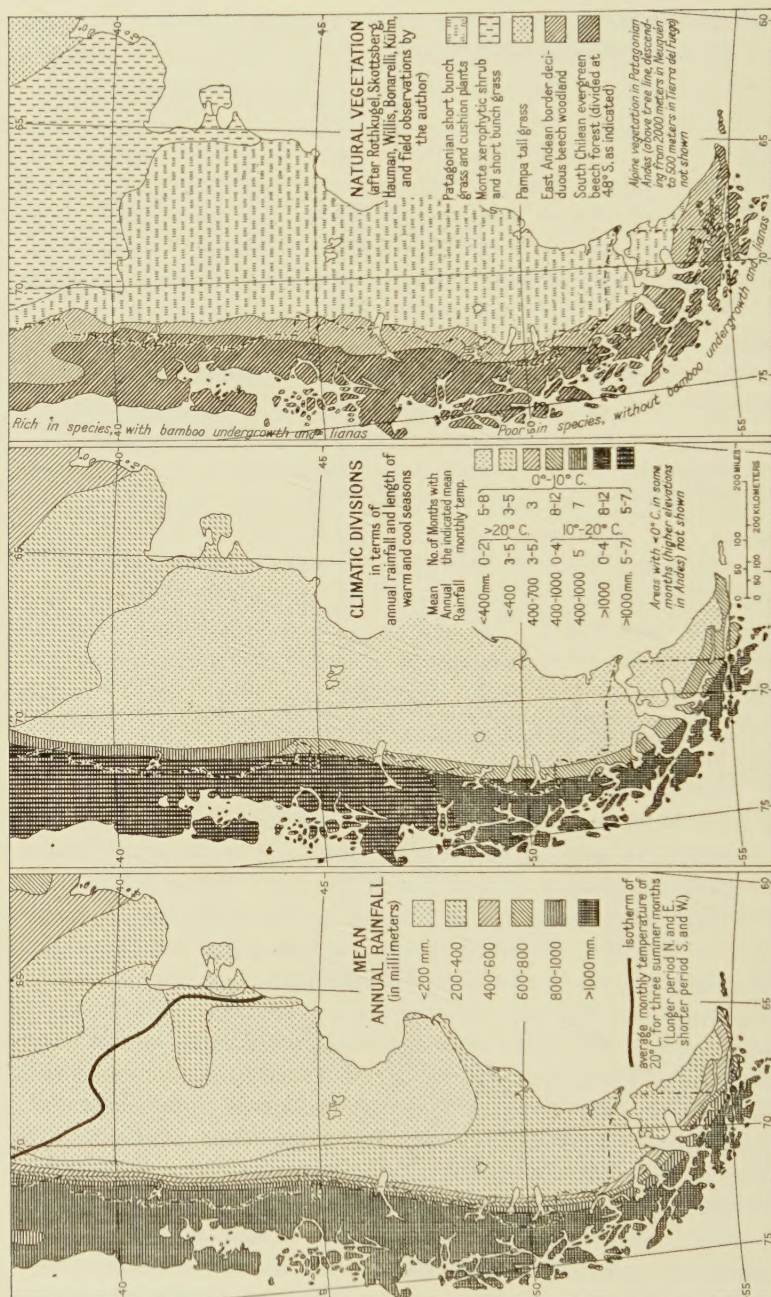
PORT	METRIC TONS OF WOOL*	METRIC TONS OF FROZEN MUTTON†
Ushuaia	38	2,914
Magallanes	11,417	17,975
Puerto Gallegos	863	3,266
Santa Cruz	49	.....
San Julián	749	1,758
Armour . . . . .	.....	2,636
Puerto Deseado	2	674
Comodoro Rivadavia	1,122	.....
Camarones	162	.....
Puerto Madryn	1,337	.....
San Antonio	3,853	.....
Total	19,592	29,223

*1925 for Magallanes (formerly Punta Arenas), 1923 for other ports.

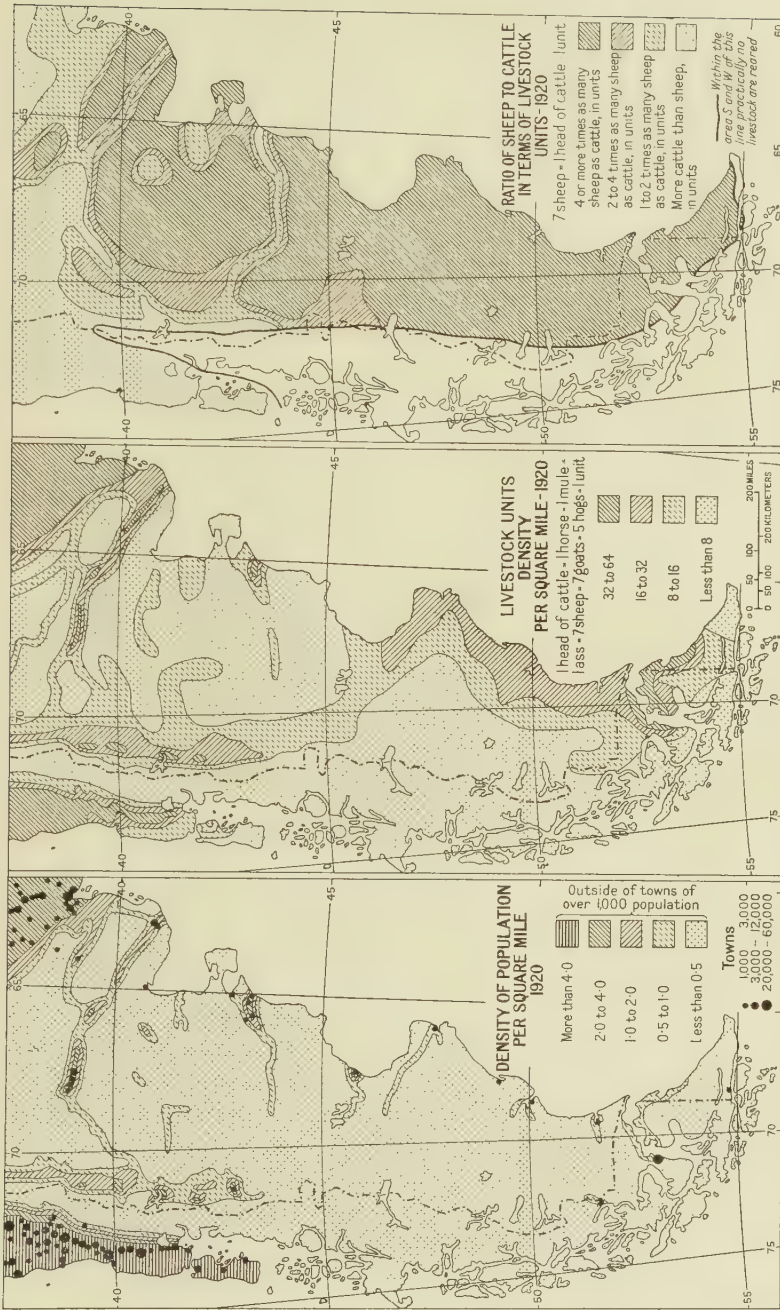
†1925 for Magallanes, 1927 for other ports. The figure for Ushuaia is for Cia. Frigorífica Argentina, the location of which in Tierra del Fuego is unknown to the author of this paper.

To these ports each year after the shearing season long lines of carts loaded with wool make the slow (in many cases several weeks long) journey necessary to get the chief export of the region to a point where ocean carriers can take it to the markets of Europe and North America. From these ports the carts return to the ranches, laden with the variety of products, largely manufactures and foodstuffs, needed but not produced on the ranches.

The several railway lines reaching various distances inland from the Atlantic (Fig. 1) have in recent years greatly shortened the cart hauls from ranches in their respective zones of influence. A few years after construction was begun on these railroads the automobile was introduced into Patagonia. It seems not to be much used yet for trucking, probably because of the absence of sufficiently good roads. For transporting people and mails and light goods, however, it has proved of great value, for much of the dry plains and plateau country can be traversed even where little or no road construction has been done.



FIGS. 2-4.—Rainfall, climatic divisions, and vegetation of Patagonia. Scale, 1 : 20,000,000. (Based on publications cited in the bibliography: Figures 2 and 3 on G. G. Davis, Figure 4 on the authors enumerated under the title.) Since the meteorological stations are far apart in most of Patagonia, the lines drawn on Figures 2 and 3 involve a series of plausible assumptions based on the relief and natural vegetation.



FIGS. 5-7.—Population density, livestock density, and ratio of sheep to cattle in Patagonia. Scale, 1 : 20,000,000. (Based on the map and the publications cited under República Argentina and República de Chile in the bibliography.) The densities were calculated from the areas of the departments, measured by planimeter on that map, and the statistics in the government publications. The isopleths were then drawn with reference not only to these densities but also to facts observed by the author in the field and obtained in the literature.

THE OASES OF IRRIGATION CROPPING

In the valleys of the Río Negro and the Río Chubut, which cross Patagonia from the Andes to the Atlantic, irrigation cropping has been developed and supports a population considerably denser than that in the sheep ranching country traversed by these streams (Figs. 1, 5, and 8). Of these irrigated oases, the flat-floored, bluff-bordered valley of the Río Negro, cut 100 to 300 feet below the general level of the plateau, is the most important. The irrigated zone in this valley extends, with some interruptions, from near the junction of the Río Neuquén and the Río Limay to the Atlantic Ocean. A variety of crops is raised, but alfalfa dominates areally in the crop association (Table VII, p. 140); the vine for wine yields greatest cash returns. The availability of alfalfa forage presumably is what makes possible the considerably denser livestock population in and near the valley (Fig. 6) than is the rule elsewhere in the dry region and likewise the dominance of cattle over sheep (Fig. 7), although definite statements to this effect have not been found. Traversed by the railroad from Bahía Blanca to Zapala (Fig. 1), this ribbon of cultivation, with green fields, fruit trees, vineyards, irrigation ditches, and farm villages, offers a delightful and economically significant contrast to the sheep ranges stretching away on either side for many miles. Six towns in the Río Negro oasis, each with a population of between 1000 and 3000, bear testimony to the much higher productivity of the irrigated crop lands as compared with the dry ranching lands.

Along the lower course of the Río Chubut another stretch of irrigated land, less extensive than that along the Río Negro, supports a second group of distinctly denser population than is characteristic of the sheep ranching country (Figs. 1, 5, and 8). Alfalfa again is here the dominant crop, in this case shipped in significant amounts to the ports farther south along the Atlantic. Four towns of between 1000 and 3000 population are located in this irrigated area.

A third area of irrigation cropping, as yet but little developed, lies along the Río Colorado, extending downstream in a tenuous line from a point some 80 miles above the town of Río Colorado.

Other than these three major irrigation areas in Patagonia, there are only small patches of irrigated land a few acres in extent near ranch centers, supplied with water from small streams which head in most cases in springs at the base of plateau scarps and flow only a few miles before disappearing.

THE CATTLE RANCHING ZONE OF THE
EAST ANDEAN BORDER

Along the western border of the dry sheep country, close to the eastern edge of the Andes, between latitudes 37° and 44° S., is a long and narrow zone of hill and valley country with between 400 and 1000 millimeters of annual rainfall and originally with a patchy



FIG. 8—Land in crops in northern Patagonia, 1920. Scale, 1 : 10,000,000. One dot represents 250 hectares, approximately one square mile. The part of Patagonia south of the map has almost no land in crops except a little along the lower course of the Río Gallegos.

vegetation cover of grassland and deciduous forest (Figs. 3 and 4). In this zone cattle rather than sheep ranching has been developed (Figs. 6 and 7), in connection with which much of the forest has been burned off to add pasture area. The pasturage is luxuriant, favoring cattle rather than sheep rearing and supporting a denser total livestock population than does the vegetation of the dry region to the east. Some crops, chiefly wheat, also are raised (Fig. 8) without irrigation; these in part are used to feed the local population and in part furnish supplementary fodder to livestock. The density of population of this Andean border zone in places approaches that of the irrigated oases, although in general it is intermediate between that of the latter areas and of the sheep country (Fig. 5).

Strongly isolated at the present time, this Andean border zone

of ranching and some farming supports only one town having a population of as much as 1000. Connections with the outside world are westward across the Andes to Chile or eastward to the Atlantic ports (Fig. 1). On the two main routes across the Andes launches or small steamers traverse Lakes Nahuel Huapí, Todos los Santos, and Llanquihue on the route to Puerto Montt and Lakes Lacar, Pirehueico, and Ríñihue on that to Valdivia, with carts or riding and pack animals employed on the inter-lake stretches. Eastward towards the Atlantic carts for goods and automobiles for people make connections with the railways from the ports. The northern end of the Andean border zone has the most effective external connections, by way of the Southern Railroad to Bahía Blanca, over which line cattle are sent to the Pampas. The driving of cattle over the Andes to Chile, which formerly was of some importance, has largely ceased.

THE NON-AGRICULTURAL ZONE OF THE ANDES

West of the cattle ranching Andean border zone lie the rainy, heavily forested, rugged, severely glaciated Andes. Except for a few small settlements of fishermen and loggers at the mouths of valleys along the coast, the mountains are practically without population where they extend to the Pacific, namely south of Puerto Montt ($41\frac{1}{2}^{\circ}$ S.). The fact that this mountain zone has but little flat land, and that its rainfall is excessive, has precluded and probably will continue to prevent crop raising, and livestock rearing will be carried on only in the summer on alpine meadows.

AGRICULTURAL REGIONS BORDERING PATAGONIA

The type of agricultural land utilization in each of the three regions that border Patagonia may be briefly characterized as follows (see Figs. 1-8 and Table II):

1. Adjoining the sheep ranching region on the northeast is the grain farming region of the outer pampas. In this plains region of fertile, dark-colored grassland soils and light to medium rainfall the growing of wheat on large farms for export is the major agricultural interest. No small part of the area, however, still remains in the hands of ranchers, who graze cattle and sheep on the natural grass.

2. North of the sheep ranching region and west of the grain farming region of the outer pampas is the cattle ranching region

of the *monte*, a dry, bush-covered country unsuited to cropping except in districts where water is available for irrigation and poorly suited to sheep rearing because of the thorny bush cover.

3. West of the Andes in Chile, and extending northward from the island of Chiloé (about $43\frac{1}{2}^{\circ}$ S.), is the livestock and grain farming region of southern Chile, where pioneer farming is gradually expanding as the forests are cleared.

HISTORY OF THE SETTLEMENT OF PATAGONIA

The history of white settlement in Patagonia, and of the accompanying economic development, is a short one. Although explorers touched at various points along the coast subsequent to Magellan's discoveries in 1520 and Jesuits from Chile established short-lived mission stations near Lake Nahuel Huapí in the late seventeenth and the early eighteenth centuries, practically nothing was known about the interior of Patagonia until Captain Musters in 1869-1870 traversed the land east of the Andes from the Strait of Magellan to Lake Nahuel Huapí and thence went east to the mouth of the Río Negro. Following Musters a number of explorers sketched in the outlines of a fair knowledge of the interior before settlement began in the early eighties of the nineteenth century. It is not strange that, except for a tiny colony on the lower Río Negro at Carmen, a small group of Welsh settlers on the lower Río Chubut, a few Chileans in the vicinity of Punta Arenas, and a few more Chileans near the Andes, settlement of Patagonia was delayed until so late. The Pampas region of Argentina and the Great Valley of Chile sufficed until about this time to take care of immigration and the natural increase of population. The Atlantic coast of Patagonia, with its barren semi-desert landscape and its few and poor harbors, offered no attractions; the rainy, densely forested, mountainous Pacific coast south of Puerto Montt was equally uninviting. Furthermore, the native Indian population of Patagonia was hostile to settlement by the whites.

The Indians, however, were subdued in a series of campaigns between 1879 and 1883, and soon thereafter three streams of population began to move into Patagonia and to occupy the land, one southward from the Pampas along the Atlantic coast and thence into the interior, a second northward from Punta Arenas, and a third eastward across the Andes from the Great Valley of Chile. Independent of these movements, settlers from the Welsh

TABLE IV.—NUMBER OF LIVESTOCK IN THE SOUTHERN TERRITORIES OF ARGENTINA AND CHILE, 1888-1920*

TERRITORY	1888			1895			1908			1914			1920		
	TOTAL LIVESTOCK	SHEEP	CATTLE	TOTAL LIVESTOCK	SHEEP	CATTLE	TOTAL LIVESTOCK	SHEEP	CATTLE	TOTAL LIVESTOCK	SHEEP	CATTLE	TOTAL LIVESTOCK	SHEEP	CATTLE
Neuquén	?	?	?	297.5	51.1	173.7	427.2	96.1	193.7	412.2	113.2	152.3	376.3	103.0	139.5
Río Negro . . .	135.4	41.1	77.4	267.6	144.2	82.1	1154.4	674.9	279.5	672.1†	400.3	91.0	641.7†	379.3	104.1
Chubut	?	?	?	50.0	6.8	29.9	809.4	303.4	335.0	542.7†	292.4	135.8	453.5†	269.1	87.6
Santa Cruz . . .	?	?	?	71.2	52.7	10.6	403.4	341.1	25.3	657.1	582.9	43.5	742.9	627.6	60.3
Tierra del Fuego	0.1	0.0	0.1	2.1	1.0	0.8	214.1	191.8	11.9	123.4†	112.0	6.3	108.3	96.7	6.5
Magallanes (Chilo)	?	?	?	?	?	?	397.7	257.2	32.0	328.5	284.0	28.7	288.3	260.0	14.9
Total							3,316.2	1,864.5	877.4	27,601	1764.8	457.6	2611.5†	1735.7	412.9

*In terms of 1000 livestock units (rating 1 livestock unit as 1 horse, 1 head of cattle, 1 mule, 1 ass, 7 sheep, 7 goats, or 5 hogs).

†The reason for this marked decrease from 1908 to 1914 is not known to the writer. The lack of a notable increase from 1914 to 1920 may be the result of disturbed markets during and following the World War.

colony on the lower Chubut, established in 1865, went west to the eastern Andean border in 1888 and founded the colony of Diez y seis de Octubre (16th of October).

DEVELOPMENT OF RANCHING

Sheep were introduced into southern Patagonia about 1880 from the Falkland Islands and subsequently into northern Patagonia from the Pampas. Presently large blocks of land were obtained from the Argentine and Chilean governments by sheep ranching companies, and by 1895 livestock rearing had become well established. The major development of ranching, however, came after about 1900, with the establishment of regular steamship services along the Atlantic coast and the consequent assurance of a means of export of wool. Still another

factor in stimulating the development of sheep ranching seems to have been the increase in alfalfa growing in many places in the Pampas region, with a resulting tendency to feed cattle on this crop rather than sheep on the natural pasture. In the humid East Andean border cattle were introduced from Chile and furnished the basis of a livestock industry markedly different from that which developed in the dry country to the east. Table IV shows quantitatively the development of ranching in Patagonia.

IRRIGATION

Irrigation works were constructed in the upper Río Negro valley in 1885, and subsequently additional works were built farther down stream. Irregular variations in the flow of the Neuquén, which is a tributary of the Río Negro, resulted in occasional disastrous floods in the irrigated lands along the latter stream. Studies were made, therefore, and construction was completed in 1916, of storage works whereby the flood waters of the Río Neuquén are impounded a few miles above the mouth of the river in a great natural depression, the Cuenca de Vidal, and later released for irrigating additional acres. The Río Limay, which also is a tributary of the Río Negro, possesses in its headwaters in the Andes a series of lakes that help regulate the flow of the river.

RAILROADS

The Southern Railroad completed its line west from Bahía Blanca to Neuquén in 1899 and subsequently extended it to Zapala (Fig. 1). This line from Bahía Blanca has proved a boon to irrigation farmers in the valley of the Río Negro, to sheep ranchers in the sections of the dry region within reach of the rails, and to cattle raisers in the northern part of the East Andean border zone. About 1910 the Argentine government began the construction of railroads westward from several of the Atlantic ports of Patagonia. These railroads were planned to open to more effective development both the ranch lands and the potential crop lands of considerable areas. The line west from San Antonio has been constructed to within a few miles of Bariloche and facilitates wool export from the zone traversed. The short line from Puerto Madryn serves the irrigated district of the lower Chubut valley. The lines from Comodoro Rivadavia and Puerto Deseado serve sheep country. It is planned to extend the lines from San Antonio and Puerto Madryn west to the productive East Andean border zone, and if

this is done no doubt development of this now isolated part of Patagonia will be stimulated, with consequent increase in railway traffic. Surveys also have been made for extending one or both of the lines from Bahía Blanca and from San Antonio across the Andes to Chile.

GROWTH OF POPULATION

Although population density is low in Patagonia, there has been a steady increase since settlement began in the eighties of the nineteenth century, as is shown by Table V.

TABLE V—POPULATION GROWTH IN THE SOUTHERN TERRITORIES OF ARGENTINA AND CHILE, 1865-1920

TERRITORY	1865	1875	1885	1895	1912	1920
Neuquén	?	?	?	14,517	27,474	30,677
Río Negro	?	?	?	9,241	34,229	42,652
Chubut	?	?	?	3,748	23,316	31,021
Santa Cruz	?	?	?	1,058	8,192	18,462
Tierra del Fuego . .	?	?	?	477	2,275	2,608
Magallanes (Chile) .	195	1,144	2,085	5,170	17,330*	28,960
Total	?	?	?	34,211	112,816	154,380

*Population in 1907.

THE FUTURE OF AGRICULTURE IN PATAGONIA

The agricultural possibilities of Patagonia, both for rearing livestock and for raising crops, are, in certain sections at least, far from being fully utilized. A good deal is known as to these as yet unutilized possibilities, but various studies should be made, including the correlation of data now in the hands of several Argentine government bureaus, in order that so far as possible mistakes may be avoided in the future and past mistakes be rectified.

IN THE SHEEP RANCHING REGION

In the dry sheep ranching region further development undoubtedly will be along lines similar to those so far pursued. Data should be gathered, however, as to the carrying capacity of the

ranges in different parts of the region at different seasons of the year and as to desirable consequent seasonal movements of flocks. The scarcity of water for stock in summer now keeps the number of animals grazed below the carrying capacity of the vegetation on certain ranges. Artesian and other water possibilities should be investigated. Wherever possible, land still available for allotment should be sold or leased in blocks so laid out with reference to water holes as to make possible the maximum utilization of the ranges. Methods to prevent overgrazing and consequent decline in the carrying capacity of the ranges should be developed. The possibilities of growing alfalfa or other forage crops on small irrigated patches throughout the region should be canvassed, as well as the possibilities of obtaining such forage crops from the larger irrigated areas within the region and from the East Andean border, since supplementary winter feed probably would considerably increase the number of livestock that could be reared.

In southern Patagonia, where the climate of the sheep ranching region is less arid and the carrying capacity of the pasture consequently higher, the rearing of sheep for frozen mutton as well as for wool has led to some replacement of merinos by Lincolns, and the export of frozen meat from refrigerators at coast ports is increasing. The extent to which this change in type of sheep reared may well be encouraged is worthy of careful investigation.

IN THE IRRIGATED AREAS

The irrigation cropping possibilities in the valleys of the Río Negro, the Río Chubut, and the Río Colorado have been studied primarily from the engineering viewpoint. Further studies in these areas as to lands suitable for development should be carried out, studies involving availability of water, cost of supplying water, character of soils, kinds of crops that might be raised, and the probable soundness of such development. It would appear that the chief function of these larger irrigated areas, as of the small ones, may well be the supplying of supplementary feed to the sheep ranches, and the finishing of stock brought from the ranches, rather than the raising of crops to be exported from Patagonia. Certain types of crops, such as vegetables, may be raised to supply food to the local population, but wheat probably can better be imported from the Pampas farming region. At present there is only a very small acreage of any kind of crop grown south of the

lower Chubut valley on the Atlantic coast or of latitude 44° S. along the margin of the Andes (Table VI). Judging from the kinds of crops grown on the few acres now in cultivation and the climatic data available, summer temperatures in these southerly

TABLE VI—AREA UNDER CROPS IN THE SOUTHERN TERRITORIES OF ARGENTINA AND CHILE (IN HECTARES), 1895-1920

TERRITORY	1895	1914	1920
Neuquén	3,512	10,784*	9,459
Río Negro	1,458	37,166	42,606
Chubut	5,556	13,742	9,784
Santa Cruz . . . . .	.....	1,945	4,515
Tierra del Fuego . . . . .	.....	87	109
Magallanes (Chile) . . . . .	.....	.....	619
Total . . . . .	.....	.....	67,092

*Area in 1912.

TABLE VII—AREAS IN SPECIFIC CROPS, SOUTHERN TERRITORIES OF ARGENTINA AND CHILE (IN HECTARES), 1920

TERRITORY	ALFALFA	WHEAT	OATS	MAIZE	BARLEY	VINEYARDS	POTATOES	ETC.	TOTAL
Neuquén	2,705	4,487	816	391	507	77	117	359	9,459
Río Negro	26,983	4,827	2,320	3,096	2,005	1,581	497	1,297	42,606
Chubut	4,559	3,517	886	22	388	39	209	164	9,784
Santa Cruz	4,183	4	103	1	22	.....	84	118	4,515
Tierra del Fuego	.....	.....	84	.....	10	.....	...	15	109
Magallanes (Chile)	.....	.....	598	.....	.....	.....	21	.....	619
Total	38,430	12,835	4,807	3,510	2,932	1,697	928	1,953	67,092

latitudes of Patagonia are not sufficiently high to afford a period long enough to ripen wheat or maize (Table VII). Forage crops of several varieties, however, can be grown in the dry region with irrigation wherever water is available and in the Andean border without irrigation.

IN THE EAST ANDEAN BORDER ZONE

The somewhat greater density of population and of livestock and the presence of some crop growing in the Andean border zone as compared with the sheep ranching region (Figs. 5, 6, and 8) suggest that in this mountain borderland the possibilities of development may be considerable. As a matter of fact, the potentialities of this zone constituted a major reason for beginning the construction of railroads westward up the valley of the Río Negro and from San Antonio and Puerto Madryn. In the Andean border the rainfall is sufficient to produce natural pasture with a much higher carrying capacity than exists in the drier region to the east, and crops can be grown, except on the more porous soils of glacial outwash flats, without irrigation (Figs. 9A and 9B). More studies must be carried out, however, before precise estimates can be made as to how much land can be put into crops and as to how much more livestock can be reared in the area. Three types of commercial agriculture seem to have promise in addition to cattle ranching, namely dairying, apple growing (summer frosts may make this impracticable), and the production of forage crops to be sold to the sheep ranches to the east.

ECONOMIC POSSIBILITIES IN THE PATAGONIAN ANDES

A not unimportant phase of the economic development of the Andean border is closely related to the non-agricultural forested mountains to the west. This latter zone is one of great natural beauty. Its heavily glaciated mountains and valleys with many arrestingly beautiful lakes and streams are a resource that has been recognized by the Argentine government in its establishment of the Parque Nacional del Sur and in the proposal of the Chilean government to establish a similar recreation reserve. If this mountain zone develops into tourist country, as it well may, the agricultural border zone is the area where hotels will be established and various other means of caring for visitors set up. An important local market for the products of farms and ranches will thus develop, and the prosperity of the area be increased. From the tourist standpoint further study of both the Andean border and of the mountain zone is desirable.

In addition to the value of the Andean forests in Patagonia as regulators of stream flow and as elements in the scenic beauty of the landscape, they constitute a readily available source of fuel and

gradient of these streams is high, and consequently the power resource is great. At present, however, no important use is made of this resource. With the building of railroads to and across this section of the Andes, hydro-electric power might be used to run the trains, for coal imported from overseas would be costly. The demands of the local population for current for light and for small amounts of power in the towns and on ranches could also be met. Whether or not any considerable manufacturing industries will develop to use much of the possible electric power is highly conjectural.

RANCHING PROBABLY THE DOMINANT INDUSTRY OF PATAGONIA IN THE FUTURE

No mineral wealth of significance except the petroleum field at

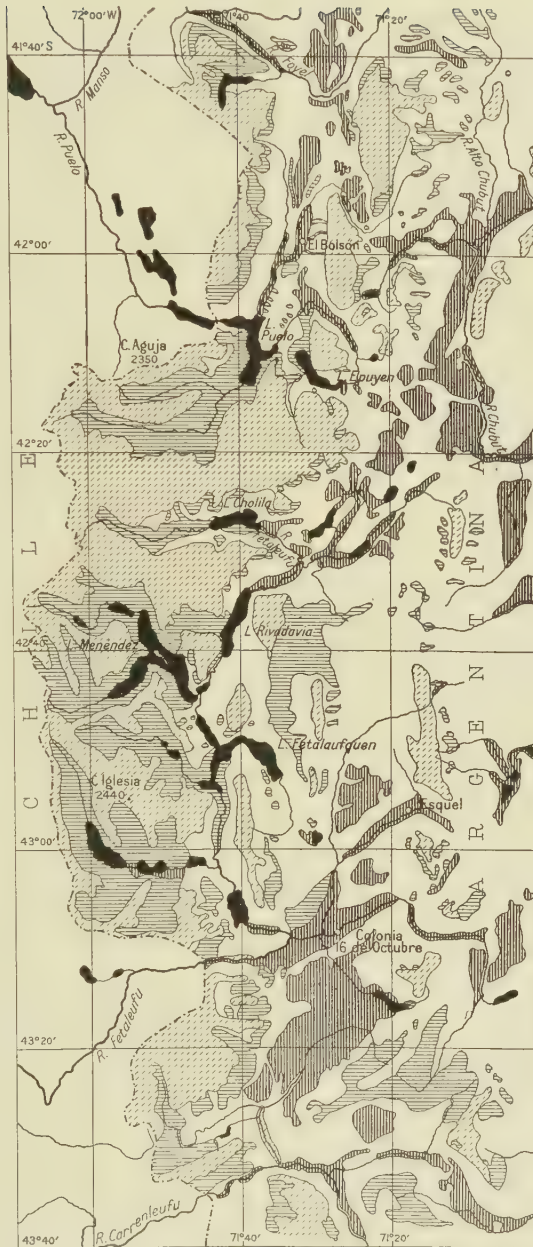


FIG. 9B (title concluded)—Lakes are in black. The white areas in Argentine territory represent grazing lands, composed of recently burned forest areas, brushy mountain slopes, and drier grassland areas east of the Andes. The map is reduced and generalized from the land classification maps on a scale of 1 : 200,000 in Bailey Willis: Northern Patagonia, New York, 1914.

Comodoro Rivadavia has been discovered in Patagonia. It appears likely, therefore, that, except for a possible future tourist business in and near the Andes, continued development of the southern territories of Argentina and Chile will rest on agriculture—sheep or cattle ranching for the most part, with subsidiary crop raising in places.

The pioneer character of agricultural development in most parts of Patagonia is strongly pronounced. The relatively new and unstabilized sheep ranching industry dominates the economic life; changed though it may become in numerous respects, ranching undoubtedly is the best use of most of the area and will continue economically supreme. Close settlement can never be expected except in the larger irrigated valleys and in the East Andean border. In the latter areas lies most of the land now under crops, and only in these areas can there ever be much increase in crop acreage.

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